**Ex-Ante Evaluation Paper (for Japanese ODA Loan)**

**South Asia Division 1, South Asia Department, JICA**

## 1. Name of the Project

Country: India

Project: Mumbai Metro Line 3 Project (III)

Loan Agreement: March 27, 2020

## 2. Background and Necessity of the Project

(1) Current State and Issues of the Urban Transportation Sector in India

In India, a country that has undergone rapid urbanization in recent years, while the demand for road transportation is increasing as the number of registered automobiles rapidly increases (55 million in 2001 to 230 million in 2017), the public transportation infrastructure has not been developed and traffic congestion has become a serious problem in large cities such as Delhi, Mumbai, and Ahmedabad, so economic loss and health hazards due to automobile pollution, such as air pollution and noise, etc.. are growing into serious problems. Therefore, it has become necessary to develop public transportation systems to improve traffic congestion and the urban environment.

The Government of India, in the New Metro Policy established in 2017, has placed emphasis on the development of the public transportation system in order to address the issues above from the perspectives of responses to the increased demand for transportation, safety and energy efficiency improvement, and social environment conservation.

The Mumbai metropolitan area, which has a population of 23.6 million as of 2019, is one of the largest metropolitan areas in India. Mumbai, located at the center of an area whose population density is 26,900 people/km$^2$, is an overpopulated city whose population density is the fourth highest in the world. As with the whole of India, the number of registered automobiles in Mumbai has rapidly increased, from 1.03 million in 2001 to 3.06 million in 2017. Therefore, the average vehicle speed in major roads of the city is 15km/h (2017), causing serious traffic congestion. On the other hand, the development of a large-scale transportation system has become a challenge because it is difficult to expand road networks owing to insufficient sites, and it is difficult to improve the transportation capacity of busses that already exist in public transportation. The Government of Maharashtra formulated the Mumbai Metro Master Plan in January 2004 toward the mitigation of congested existing public transportation,

improvement of traffic conditions, and mitigation of air pollution in Mumbai metropolitan area. They have promoted the plan centered on a total of nine lines of the mass high-speed transportation system and the development of urban railways, which extend for 147.4km. Against such a background, the Mumbai Metro Line 3 Project (hereafter “the Project”), which starts from the southern edge of Mumbai, goes through the central part of the city, connects to Mumbai International Airport, and reaches the suburban area in the northern part of the city, is regarded as a project which should be implemented early and an essential project for the promotion of economic growth of the Mumbai metropolitan area.

(2) Japan and JICA’s Urban Transportation Sector/India Cooperation Policy and the Positioning of the Project

In Country Assistance Policy for India (March 2016), where connection enhancement through the development of transportation infrastructure, etc. was set as an assistance priority field, with the removal of bottlenecks in the infrastructure to the investment and growth in mind, it is necessary to develop railways (including high-speed railways and urban railways) in order to enhance the connection between major industrial cities, economic zones, and the regions in India. Moreover, in the paper of the JICA Country Analysis Paper for India (March 2018), an analysis shows that it is necessary to promote the development of the regional economy, promote the efficiency of logistics, and support infrastructure development such as trunk railways, urban railways, roads, and harbors that contribute to the investment expansion by foreign capital mainly in the regions of concentrated industry such as special economic zones and economic corridors, etc. located in 6 major metropolitan areas in India and the Delhi-Mumbai Industrial Corridor in order to remove bottlenecks in the economic growth. The Project is consistent with the policies and these analyses. Furthermore, in the ODA loan to India, there is an approval record of 66 loans, 2.5845 trillion yen as of the end of July 2019, to the transportation traffic sector, and assistance has been provided to subway projects from Delhi Metro to the railroad and urban transportation sector, with an ODA loan approval record of 41 loans, 2.0413 trillion yen as of the end of July 2019. Moreover, the first loan (2013 L/A signed, approved amount: 71,000 million yen) and the second loan (2018 L/A signed, approved amount: 100,000 million yen) have already been provided for the Project.

Furthermore, the Project is considered to contribute to the achievement of the

SDGs Goal 9 (construction of robust infrastructures) and Goal 11 (comprehensive, safe, robust, and sustainable city).

(3) Other Donors' Activities

The World Bank is supporting the Mumbai Urban Transportation Project (development of roads and suburban railways) and the Eastern Corridor Development of Freight Railway Construction Plan, etc. and has an approval record of 81 loans,18,274 million dollars as of the end of July 2019, to the transportation traffic sector. The Asian Development Bank has an approval record of 176 million dollars to Jaipur Metro and has performed co-financing with the New Development Bank to Mumbai Metro (2A, 2B, and Line 7) in February 2019 (approved amounts are 926 million dollars and 260 million dollars respectively), and has an approval record of 61 loans, 14,532 million dollars, as of July 2019. AFD has approval records of 180 million euros to Kochi Metro in February 2014 and 310 million euro to Bangalore Metro in January 2016. The Asian Infrastructure Investment Bank performed co-financing with the European Investment Bank to Bangalore Metro in December 2017 (approved amounts are 335 million dollars and 583 million dollars respectively).

## 3. Project Description

(1) Project Objective

The objective of the Project is to cope with the increase of traffic demand in Mumbai by expanding the mass rapid transportation system, thereby promoting regional economic development and improving urban environment, through mitigation of traffic jams and decrease of pollution caused by increasing motor vehicles.

(2) Project Site / Target Area

Mumbai metropolitan area, Maharashtra

(3) Project Components

a) Civil engineering work and building work (all lines underground: approx. 33.7km, 26 stations, one at grade station)

b) Vehicle maintenance base facility procurement

c) Track work (laying rail tracks of approx. 33.7km)

d) Electric and machine work (development of wires and substations, etc.)

e) Signal and communication work (development of signal and communication systems)

f) Automated charge-receiving system procurement

g) Underground section ventilation facility installation work
h) Automatic elevating facility installation
i) Vehicle procurement (248 cars: 8 cars per line x 31 lines)
j) Other (vehicle maintenance base work, station security facility procurement)
k) Consulting services (bidding assistance and construction management, etc.)
All items above except j) are a target of ODA loans. (As for rolling stocks, ODA loan covers procurement of 210 rail cars)

(4) Estimated Project Cost

523,997 million yen (of which, the ODA Loan amount is 39,928 million yen)

(5) Schedule

June 2013 - December 2021 (103 months in total). The Project will be completed upon the commencement of services of all facilities (December 2021).

(6) Project Implementation System

1) Borrower: President of India
2) Guarantor: None
3) Executing Agency: Mumbai Metro Rail Corporation Limited: MMRCL
4) Operation and Maintenance System: The maintenance/management after the completion of the project is to be performed directly by the MMRCL

(7) Collaboration with Other Schemes and Donors

1) Japan's Assistance Activity: N/A
2) Other Donors' Assistance Activities: The World Bank is developing the roads and suburban railways in the Mumbai urban transportation project. The Asian Development Bank performed co-financing with the New Development Bank to Mumbai Metro (2A, 2B, and Line 7) in February 2019.

(8) Environmental and Social Consideration / Cross-Sectoral Issues / Gender Category

1) Environmental and Social Consideration

① Category: A

② Reason for Categorization

The Project falls into the railway sector and is likely to have a significant adverse impact due to its characteristics under the Japan International Cooperation Agency Guidelines for Environmental and Social Considerations (published in April 2010).

③ Environmental Permit

Although there is no obligation to prepare an environmental impact

assessment (EIA) report concerning the Project in the domestic laws of India, it was already prepared in September 2012. In implementing the Project, it is necessary to obtain tree-cutting permission, forest clearance, and coastal regulation zone clearance by the time of initiation of work in some regions, and all such approvals had already been obtained by September 2019.

④ Anti-Pollution Measures

For the work, mitigation measures such as pollutant countermeasures and appropriate management of work vehicles and heavy equipment have been taken. Regarding the impact of work on the ground, no significant impact due to subsidence is expected because loose ground and influx of underground water are prevented by the adoption of a shield tunneling method. After the commencement of services, mitigation measures are taken, such as sound insulating walls as a noise countermeasure, the installation of elastic rubber layers under tracks as a vibration countermeasure, and the installation of an effluent treatment facility at the vehicle base as a water quality pollution countermeasure. Moreover, in the resident discussions concerning the EIA report of the Project, concerns about the noise, air pollution, and disposal of work surplus soil and requests for the work restriction at nighttime were received, so the implementation institutions have promised and implemented the mitigation measures and monitoring respectively. At present, no particular objection to the Project has been made by residents.

⑤ Natural Environment

The Project target region is located 1.5 km away from Sanjay Gandhi National Park, but no rare species of animals, etc. inhabit the surrounding areas, so the adverse effect on the natural environment is expected to be minimal. It is necessary to cut down 5,731 trees in total and 0.91ha of mangrove forest in order to implement the Project, so alternative tree planting has been performed. Moreover, some residents conducted activities against tree cutting in the planned site for Cuffe Parade Station in Colaba region and filed a lawsuit with Mumbai High Court seeking the Project's suspension on February 3, 2017, but it was dismissed by the Supreme Court on May 18, 2017. The MMRCL were cutting trees starting from the work section, for which permission and approval have been

obtained, and suspended cutting trees in the district which was the target of lawsuit during the lawsuit period but restarted after the dismissal. Moreover, residents are conducting activities against tree cutting concerning the construction of an early colony vehicle base, and the implementation institution is providing further explanation to residents toward consensus formation.

⑥ Social Environment

The land acquisition area of the Project is approx. 76.00ha (private property: approx. 2.86ha) and 1,837 households (5,119 people) of 2,888 households (7,273 people) that are affected by the Project are expected to be relocated. The MMRCL, holding discussions with the people affected by the land acquisition and resettlement, is going through procedures in accordance with the resettlement action plan (based on the Act on New Site Acquisition and resident transfer policies of the state government of Maharashtra, etc.) formulated to meet the requirements of JICA guidelines and is planning to complete the procedures of land acquisition and resettlement by June 2020. Moreover, ownership of a section of the housing project prepared in the suburbs of Mumbai and transfer expenses, etc. are offered to illegal residents.

⑦ Other / Monitoring

In the Project, the MMRCL performs the monitoring of land acquisition and resettlement during the construction and the contractor performs the monitoring of noise, vibration, soil, air quality, water quality, and waste, etc. under the supervision of the MMRCL. After the commencement of services, the MMRCL performs the monitoring of noise, vibration, air quality, and water quality, etc. Moreover, the MMRCL is using its own capital to employ external professional consultants and performing the monitoring of land acquisition, resettlement, and living conditions after the relocation.

2) Cross-Sectoral Issues

A lot of workers engaged in the Project are residing alone and presumed to have a high risk of HIV infection, so referring to the countermeasures in Delhi Metro, the MMRCL is using its own capital to conduct HIV/AIDS prevention activities in collaboration with NGOs also in the Project as a social contribution activity. At the same time, the HIV/AIDS prevention provisions are contained in bidding documents, and contractors are requested to collaborate in HIV/AIDS countermeasures for workers.

In accordance with the domestic regulations of India, station buildings and passenger carriages considerate of utilization by elderly and disabled people, etc. (elevator, toilet, announcements at a station, Braille blocks, and space for wheelchairs, etc.) are adopted, and customer care training is planned to be provided to all frontline staff such as station staff and crew.

Moreover, regarding the climate change, the traffic congestion due to the utilization of automobiles is mitigated by constructing a mass high-speed transportation system, which contributes to the reduction of greenhouse gas (GHG) emissions. The climate change mitigation effect of the Project (estimated GHG emissions reduction) is approx. 261,968 tons of CO2/year.

3) Gender Category: ■GI (S) (Gender activity integration project)

<Activities/Classification Rationale>

The Project is making efforts such as allocating priority seats, installing CCTV cameras in station buildings and passenger carriages, and low straps, etc. so that women can use the subways safely and comfortably. Therefore, it falls under the category of an integrated gender activity project.

(9) Other Important Issues**:** N/A

## 4. Targeted Outcomes

(1) Quantitative Effects

1) Outcomes (Operation and Effect Indicators)

| Indicator | Baseline (in FY2014) | Target (2023) [2 Years after Completion] |
|---|---|---|
| Vehicle operation rate (%/year) | ― | 87 |
| Vehicle kilometer (x 1,000 km/day) | ― | 73 |
| Number of times trains are operated (times/day, one direction) | ― | 676 |
| Passenger transportation amount (x 1 million people, km/day) | ― | 13.8 |
| Passenger revenue (x 1 million rupee/day) | ― | 28.3 |

The section between Cuffe Parade Station and the Early Colony Vehicle Base Station (measured by the MMRCL)

(2) Qualitative Effects

Improvement of traffic conditions in the Mumbai metropolitan area (reduction in the number of vehicles), mitigation of pollution, mitigation of climate change,

improvement of convenience by securing the punctuality of transportation, and economic growth in the Mumbai metropolitan area.

(3) Internal Rate of Return

According to the following preconditions, the Project's Economic Internal Rate of Return (EIRR) will be 12.96%. The Financial Internal Rate of Return (FIRR) will be 2.23%.

[EIRR]

Cost: Project costs and operation/maintenance costs (both excluding tax)

Benefit: Operation/maintenance cost reduction effects concerning transportation and roads (including road congestion mitigation and bus transportation), travel time reduction effects for the users of the main line and other transportation, reduction in traffic accidents, and pollution (including greenhouse gases) mitigation effects.

Project Life: 30 years

[FIRR]

Cost: Project costs (including taxes) and operation/maintenance costs

Benefit: Passenger revenue, advertising revenue, and in-station development revenue

Project Life: 30 years

## 5. External Factors and Risk Control

(1) Preconditions: N/A

(2) External Factors: N/A

## 6. Lessons Learned from Past Projects and Application to the Project

Lessons were obtained from the results of an ex-post evaluation of the Delhi High-Speed Transportation System Construction Project in India that tell us it is preferable to encourage public transportations to collaborate with each other to compose systematic urban transportation and be managed efficiently as a whole public transportation instead of competitive relationships and it is important to establish a financially-independent project implementation system from the perspective of securing appropriate operation and maintenance.

In the Project also, discussions have been had concerning the connection arrangement with bus lines managed by Brihanmumbai Electric Supply and Transport and Mumbai Metro Line 1 and 2 and monorails implemented by the

MMRDA. Moreover, the MMRCL is planning a project related to commerce and real estate development and is making efforts to enhance financial strength.

## 7. Evaluation Results

JICA has supported metro projects in large metropolitan areas, and the Project contributes to the balanced economic growth in the Mumbai metropolitan area through traffic congestion mitigation and traffic pollution reduction in the area, which is consistent with the assistance policies of our country and JICA. Moreover, the Project is considered to contribute to the achievement of SDGs goal 9 (construction of robust infrastructures) and goal 11 (comprehensive, safe, robust, and sustainable city), so it is highly necessary for JICA to support the implementation of the Project.

## 8. Plan for Future Evaluation

(1) Indicators to be Used

As indicated in sections 4. (1) to (3).

(2) Timing of the Next Evaluation

Two years after the project completion

End